AN ASSESSEMENT OF ANKLE STABILITY IN ELITE RUGBY UNION

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The aim of the study was to assess dynamic postural stability and the perceived chronic ankle instability (CAI) in a population of elite rugby union players, and to examine the relationship between these two measures. Thirty-three professional rugby players undertook the Cumberland Ankle Instability Tool (CAIT) as well as dynamic postural control testing using the Y-balance test (YBT). Significant differences of between-limb performance in the posterolateral direction on the YBT were seen for those athletes reporting perceived CAI in one or both ankles when compared to no perceived CAI ($p = 0.00$). These findings suggest poorer lateral dynamic postural control at the ankle in those athletes who identify as having CAI. By administering these tools together, the study suggests that we are able to identify athletes who may benefit from targeted intervention programs to address compromised ankle stability and potential CAI progression.

KEYWORDS: ankle, stability, rugby.

INTRODUCTION: Rugby union is a field-based sport where players are required to undertake changes of direction and controlled movements of the centre of mass, whilst reacting to on-field player movements and events (Green, Blake & Caulfield, 2011). Ankle injuries are common in athletes required to perform such movements (Zoch et al, 2003) and represent 11% of match injuries and 15% of training injuries in rugby union players (Sankey et al, 2008). The International Ankle Consortium (Gribble et al, 2016) reports that lateral ankle sprain (LAS) is the most common musculoskeletal disorder documented in physically active populations made up 43% of ankle injuries sustained in rugby union (Sankey et al, 2008). Acute LAS causes pain alongside temporarily reduced functioning and disability (van Rijn et al, 2008), and whilst early management and follow-up treatment can modulate the healing process, this is often not the case. A high number of athletes go on to sustain at least one further LAS, and as such develop a history of injury (Fong et al, 2007). Repeat LAS sees many develop physical and subjective functional limitations, with ongoing ‘giving-way’ in the affected ankle (van Rijn et al, 2008), resulting in the defined condition of chronic ankle instability (CAI).
Poor balance has been identified as a risk factor for ankle sprain injuries (Trojian & McKeig, 2006). The assessment of dynamic postural stability has been reported to be fundamental to the effective execution of the movement patterns prevalent in rugby union, where the ability to maintain single leg stability whilst controlling multi-planar movement demands is essential (Coughlan et al, 2014). Whilst dynamic measures of postural stability do not exactly replicate sport participation, their ability to examine movement patterns and joint coordination provides direction to athlete preparation and injury prevention programs (Gribble et al, 2012). The Y-Balance Test (YBT) has been reported to be a valid and reliable assessment of dynamic ankle control, with recent studies report the that the YBT provides faster test administration with more standardized measurements when compared to other assessments (Bulow et al, 2019).
Therefore, the aim of the study was to examine the interaction between validated athlete reporting of perceived CAI and dynamic postural stability assessment of ankle function, to see if the use of such tools in screening or athlete assessment can provide an insight into athletes who may benefit from targeted intervention programs in an attempt to reduce injury risk.

METHODS: Thirty-three professional rugby union players were recruited into the study (25 ± 4 years, Mass = 185.72 ± 6.75kg; Height = 1.85 ± 0.07m) which was conducted during their pre-season training program as part of a larger testing battery of lower limb assessments. The study was approved by the institution’s ethics review board. Participants were excluded from the study if they were unable to play or train due to injury at the time of the testing or if they had experienced lower limb injury that had required surgery in the 6 months prior to testing.

Perceived ankle instability was assessed using the Cumberland Ankle Instability Tool (CAIT), a valid and reliable self-report questionnaire which assesses the perceived symptoms of ankle instability (Hiller et al, 2006). Both ankles were assessed for CAI with athletes classified as having CAI if they scored 25 or less on CAIT (Wright et al, 2014). The French translation of CAIT (Geerinck et al, 2019) and was provided to the French speaking members of the team.
Dynamic postural control was evaluated using a commercially available device (Y Balance Test, Move2Perform, Evansville, IN) using the protocol described by Coughlan et al (2012). The order of the test leg and direction were randomized for each athlete and all testing was conducted barefoot. The test was demonstrated by one member of the research team before the participant completed practice trials in each direction on each leg to decrease the learning effect (Robinson and Gribble, 2008). After test familiarisation and a two-minute rest period, participants then conducted 3 test trials in each direction (Anterior = ANT; Posteromedial = PM; Posterolateral = PL) on each leg. A trial was classified as invalid if the participant removed his hands from his hips, did not return to the starting position, placed the reach foot on the ground, raised or moved the stance foot during the test or kicked the plate with the reach foot to gain more distance. If an invalid trial occurred, the participant repeated the trial. Reach distances were normalized to standardised measurements of limb length by calculating the maximized reach distance using the formula (excursion distance/limb length) / 100 = % reach distance to allow comparison between limbs and participants. Asymmetry was calculated by the absolute difference in centimetres between right and left leg reach distance in ANT, PM, and PL (Smith et al, 2015). Mean and standard deviations were calculated for both legs.
A one-way between-groups multivariate analysis of variance was performed to investigate the effect of playing position on six independent variables being investigated: (mass, height, left right leg length, left and right ankle width). An adjusted alpha level of $p < 0.008$ was used to assess for statistical significance to account for the number of variables (Coughlan et al, 2014). Independent-samples t-tests were conducted to compare normalised reach distance scores in the ANT, PM and PL reach directions for player position and CAIT outcome score as well as between limb differences and CAIT scores. To asses CAIT scores, each ankle was evaluated independently. To account for multiple statistical testing, the p-value was adjusted for both right and left limb performance using a Bonferroni correction, such that the new p value ($p < 0.01$) was utilized to indicate a significant result.

RESULTS: Anthropometric player measures showed significant difference for body mass ($p = 0.00$) and ankle width (left ankle $p = 0.00$; right ankle $p = 0.01$) between playing positions with forwards showing significantly greater body mass and significantly greater limb width. Height and limb length were comparable across playing position (Data not shown). Despite differences in anthropometric variables between player position, no significant differences existed in YBT reach distances between playing position or in CAIT score (data not presented). When ankles were classified by presence of CAI (CAIT score > 25 vs CAIT score ≤ 25), no significant differences existed in reach directions (Table 1).

Table 1: Reach distance as a % limb length (mean ± SD) as a factor of CAIT score

Reach Direction		Reach distance
ANT	CAIT > 25 (n = 41)	72.66 ± 13.71
	CAIT ≤ 25 (n = 25)	73.55 ± 10.96
	Mean Difference	-0.92
	P-value	0.77
PM	CAIT > 25	118.29 ± 14.99
	CAIT ≤ 25	120.14 ± 14.99
	Mean Difference	-1.85
	P-value	0.62
PL	CAIT > 25	116.43 ± 14.53
	CAIT ≤ 25	120.99 ± 14.44
	Mean Difference	-4.56
	P-value	0.22

The presence of between-limb asymmetry (difference between left and right limb reach distance) was assessed for athletes with no perceived CAI (CAIT score > 25) as well as those with perceived CAI (CAIT score ≤ 25) in one or both ankles. Table 2 shows that for athletes indicating the presence of CAI, between-limb asymmetry (normalised reach distance difference > 4cm) is significantly elevated in the PL direction when compared to athletes with no perceived CAI (Both ankles p = 0.01; one ankle p = 0.00). Between-limb asymmetry is larger in those athletes with CAI indicated in one ankle, but not significantly when compared to those athletes with CAI indicated in both ankles. The results also show that between-limb asymmetry exists in all directions of the YBT, regardless of CAIT score.

Table 2: Impact of CAIT Score on the difference between limb reach distance (mean ± SD)

Reach Direction	CAIT Score	Between-limb reach difference (cm)
ANT	CAIT > 25 (n = 18)	5.38 ± 5.07
	CAIT ≤ 25 Two Ankles (n = 10)	5.15 ± 4.00
	CAIT ≤ 25 One Ankle (n = 5)	6.06 ± 10.08
PM	CAIT > 25	5.36 ± 5.56
	CAIT ≤ 25 Two Ankles	8.46 ± 9.21
	CAIT ≤ 25 One Ankle	8.83 ± 3.09
PL	CAIT > 25	4.11 ± 3.15
	CAIT ≤ 25 Two Ankles	9.07 ± 9.78*
	CAIT ≤ 25 One Ankle	11.77 ± 5.28**

* indicates significance at p < 0.01 between CAIT > 25 and CAIT ≤ 25 two ankles
** indicates significance at p < 0.01 between CAIT > 25 and CAIT ≤ 25 one ankle

DISCUSSION: The study suggests that athletes who report perceived CAI in one or both ankles have elevated instances of dynamic postural control asymmetry in the PL direction of the YBT (Table 2). The PL direction of the YBT places stresses on the lateral support mechanisms of the ankle, and so the presence of greater asymmetry between left and right limbs during dynamic stability tasks may identify a directional control mechanism which may be inhibited in athletes who report perceived CAI. This observation may gain credence given the association between the development of CAI and repeat LAS (Gribble et al, 2016). Despite reporting perceived CAI in one or both ankles, players were still actively participating in match and practice sessions, which may support the argument that athletes often under-appreciate the significance of LAS injury (Gribble et al, 2016). Studies using the YBT with athletes have previously reported between limb asymmetry of over 4cm to be associated with elevated risk of non-contact lower limb injury (Smith et al, 2015). These links were only previously reported in the ANT direction and not the PL as in this study, however these studies did not report the athlete's perception of CAI whilst assessing their dynamic postural control, which it could be argued may affect the athletes control mechanism in the other directions.
Whilst the current study identifies elevated asymmetry in the PL direction in those athletes reporting CAI, the study also finds that regardless of CAI classification, between limb asymmetry (over 4cm) is prevalent in the all directions of the YBT for this population. Asymmetry and altered dynamic postural control appear common in the rugby union and could be a contributing factor to the high incidences of reported ankle injuries (Sankey et al, 2008).
By administering these tools together, the study suggests that we are able to identify athletes who may benefit from targetted intervention programs to address asymetrical ankle stability and potental CAI progression. Intervention programs using proprioceptive training of the ankle and have been effective in reducing the incidence rate of ankle injuries in athletes (Sankey et al, 2008). If players with the capacity to benefit from intervention can be identified then they can undertake further assessment by the sports medicine team where necessary and integrated into specific neuromuscular conditioning programs to address their ankle asymmetries (Coughlan et al, 2014).

CONCLUSION: Between-limb asymmetry appears to be highly prevalent when conducting dynamic postural stability tests in elite rugby union players. Athletes who reported perceived

CAI in one or both ankles demonstrated elevated dynamic postural control asymmetry in the PL direction of the YBT, which may indicate that directional control mechanisms are further inhibited in athletes who report perceived CAI. Identifying athletes with perceived CAI as well as assessing dynamic postural control strategies may assist with the identification of athletes may benefit from the immediate implementation of medical assessment as well as ongoing neuromuscular conditioning programs. The inclusion of these easily administered, reliable and valid measures within athlete assessment programs provides the ability to identify rugby union players with reduced test performance who may benefit from targeted intervention programs.

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